



IIT ROORKEE



NPTEL ONLINE
CERTIFICATION COURSE

SPECIAL CASTING PROCESSES

Centrifugal, Investment & Continuous Casting

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MIED



CENTRIFUGAL CASTING

- Molten metal is poured into a revolving mold.
- Allowed to solidify by pressure of centrifugal force.
- Employed for mass production.
- Castings have high density and good strength.
- Promote directional solidification.
- Surface finish along the inner surface is poor than the outer surface.
- Castings produced are free from impurities (slag, oxides and other impurities being lighter, gets separated).



CENTRIFUGAL CASTING

- Molds are made of metal, sand or ceramic.
- Rotation speed (300 to 3000 rpm).
- Cylindrical parts and pipes are most adoptable to this process.

Types of centrifugal casting process

- True centrifugal casting
- Semi-centrifugal casting
- Centrifuging casting



TRUE CENTRIFUGAL CASTING

- Used for casting axi-symmetric with a concentric hole (hollow pipes, tubes, hollow bushes, etc.)
- Axis of rotation can be horizontal, vertical or inclined (usually horizontal).
 - ❖ Horizontal axis → Long pipes
 - ❖ Vertical axis → Short pipes
- Amount of metal poured determines thickness of cast/pipe.
- Water jacket is provided around mold (for cooling).
- Casting machine is mounted on wheels.
- Cores, gates and risers are not required.



TRUE CENTRIFUGAL CASTING

Cycle: → Mold is rotated.

→ Metal is being delivered at the extreme end.

→ Metal deposited all along the length.

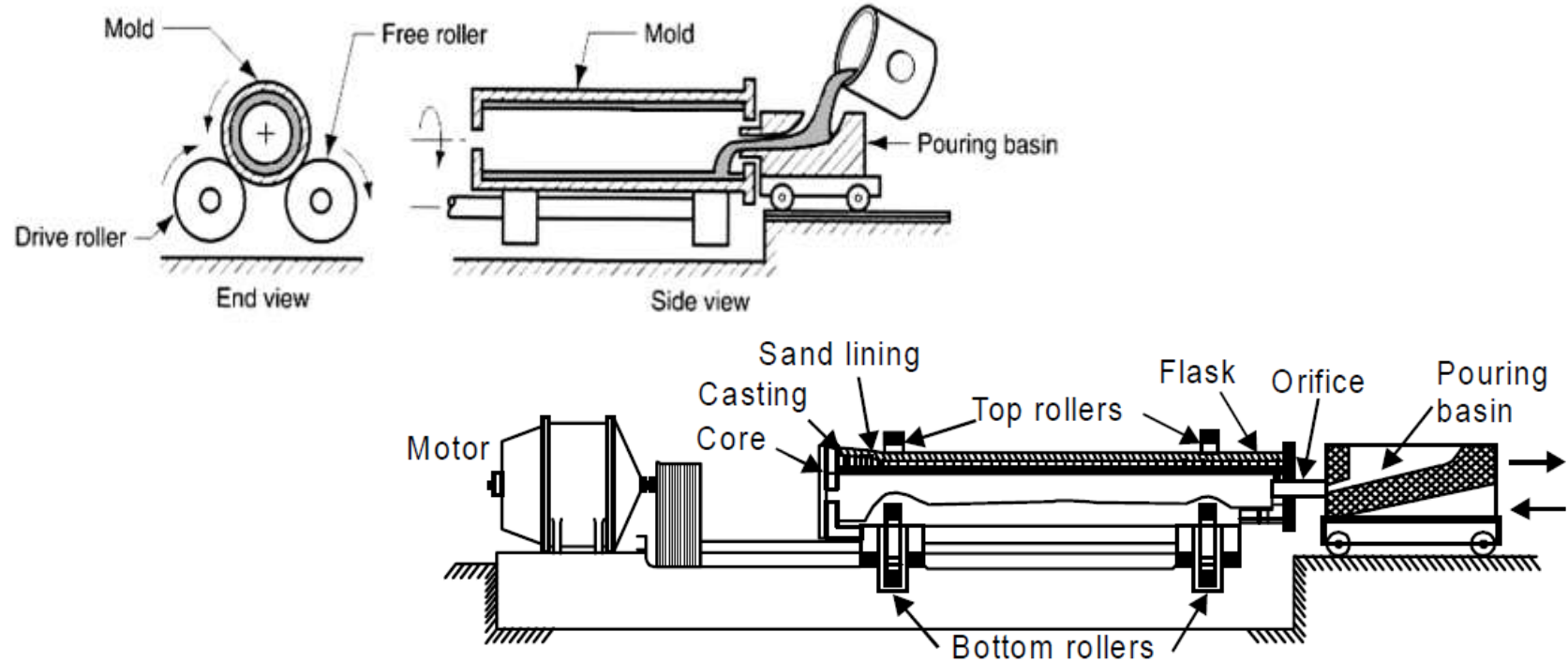
→ Continuously rotated till complete solidification.

→ Machine stops & cast is removed, cycle repeated.

Advantages	Limitations
Better mechanical properties	Only axi-symmetric with concentric hole product can be casted
No porosity and no impurities	
Proper directional solidification	Suitable for large scale production
Better casting yield	Expensive equipment



TRUE CENTRIFUGAL CASTING



SEMI-CENTRIFUGAL CASTING

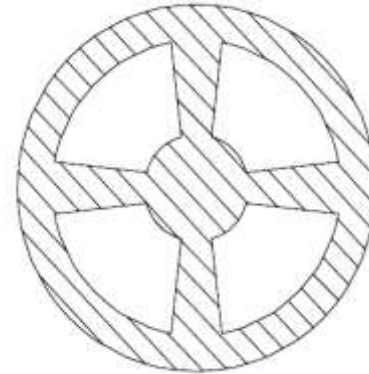
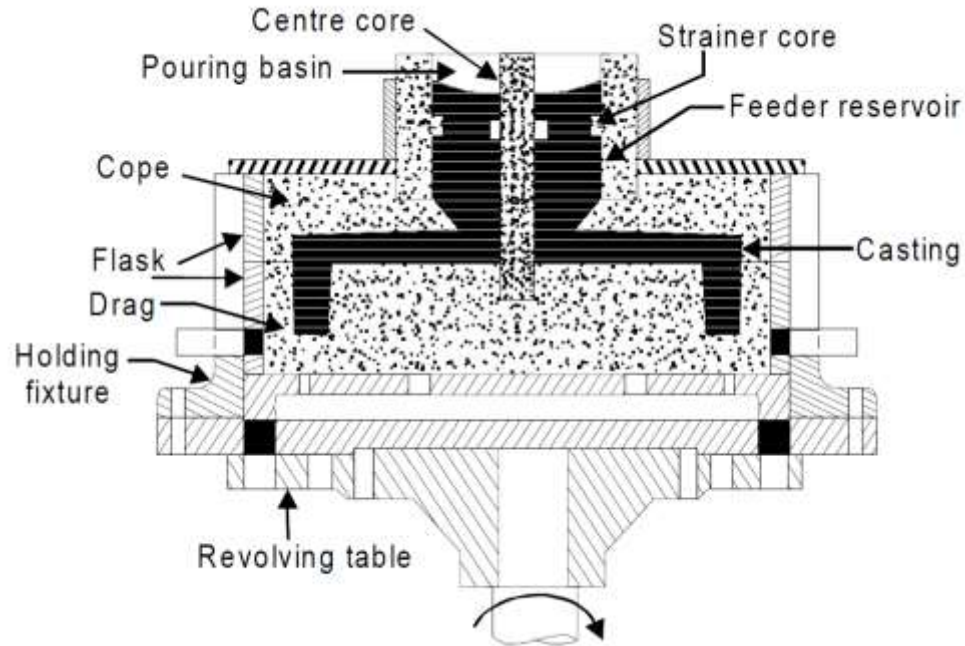
- Similar to true centrifugal casting, but a central core is used to form the inner surface.
- Sand or metal mold rotates in vertical axis.
- Cast should be axi-symmetric.
- Rotating speed is lower than true centrifugal casting.
- Metals enter in the mold through central pouring basin.
- For high yield, mold can be stacked one over other but metal feeding is from single pouring basin.

SEMI-CENTRIFUGAL CASTING

- More complicated shapes can be cast than those with true centrifugal casting.
- Particular shape is being produced by mold and core, not by centrifugal force.
- The centrifugal force aids proper feeding.
- Produces the castings free from porosity.
- Symmetrical objects namely wheel having arms like flywheel, gears, etc. can be casted.



SEMI-CENTRIFUGAL CASTING

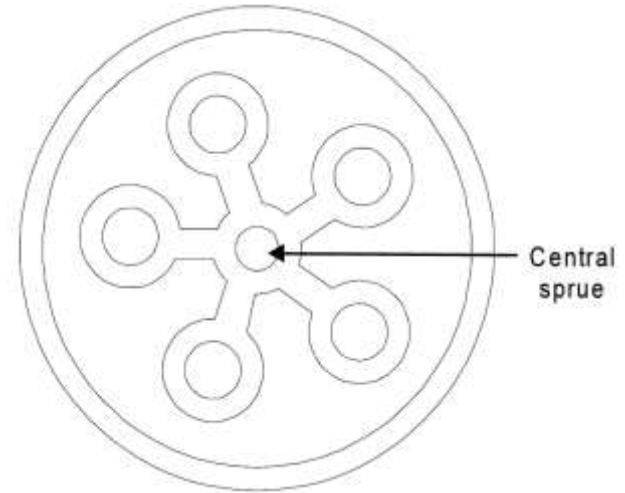
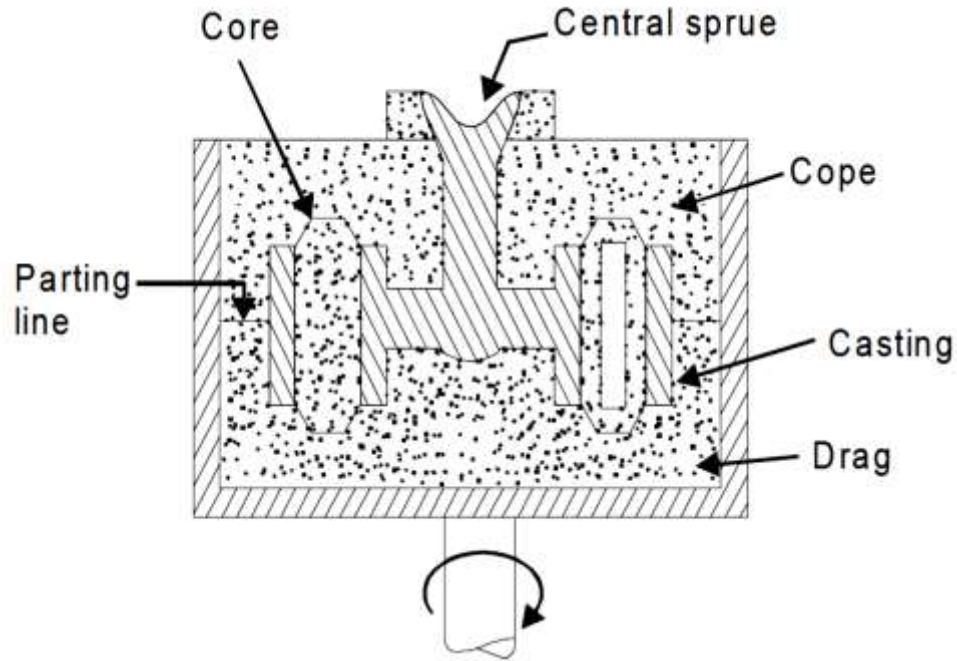


CENTRIFUGING

- Generally used for non axi-symmetrical & small castings with intricate details.
- Number of small jobs are joined together by means of a common radial runner with a central vertical sprue.
- Jobs are uniformly placed around periphery.
- Mold rotates in vertical axis.
- Obtain high metal pressure during solidification.



CENTRIFUGING CASTING



INVESTMENT CASTING

- Also known as Lost wax casting.
- Pattern is prepared from wax.
- Molten wax is injected in to metallic die at ~ 2.5 MPa.
- After solidification pattern is ejected from die.
- Several patterns are attached to sprue to form a pattern tree.
- Attachment is done by applying heat.
- Pattern tree is coated with several thin layer of refractory material to form complete mold.
- Refractory material used are fused silica, zircon, etc.



INVESTMENT CASTING

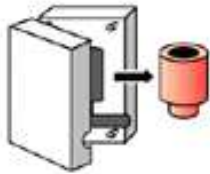
- Refractory material is coated till mold become rigid.
- The thickness of refractory coating is 6 to 15 mm (depends on casting shape and mass, type of refractory).
- Mold is heated in inverted position.
- Wax get melted and cavity is formed in mold.
- Mold is preheated to high temperature (100 to 1000°C) before pouring metal, ensures all contaminants are removed and permits liquid metal to flow more easily.
- Liquid metal is poured in to mold; it solidifies.
- Mold is broken from the finished casting.
- Parts are separated from sprue.



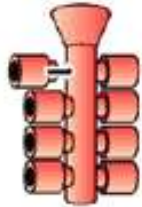
INVESTMENT CASTING

- Advantages:
 - Complex shape with thin section can cast.
 - Good dimensional accuracy, very close tolerances & surface finish.
 - No parting line.
 - No or little additional machining (net, or near-net shape process).
 - Wax can be reused.
- Disadvantages:
 - Expensive process.
 - Requires skilled labour.
- Applications:
 - Small sized & complex parts.
 - Art pieces, jewellery, dental fixtures, etc.
 - Machine elements such as gas turbine blades, pinion gears, etc.

INVESTMENT CASTING



Wax Injection



Assembly



Shell Building



Dewax/Burnout



Gravity Pouring



Knock Out



Cut-off



Finished Castings

CONTINUOUS CASTING

- Molten metal is collected in ladle.
- Poured in to a vessel called tundish (act as reservoir).
- From tundish, molten metal is continuously poured in to a water cooled copper mold.
- Mold is opened from both side.
- Due to fast cooling in the mold, solid shell (solid skin) is quickly formed at mold wall.
- Solid shell has 10 to 25 mm thickness at mold exit.



CONTINUOUS CASTING

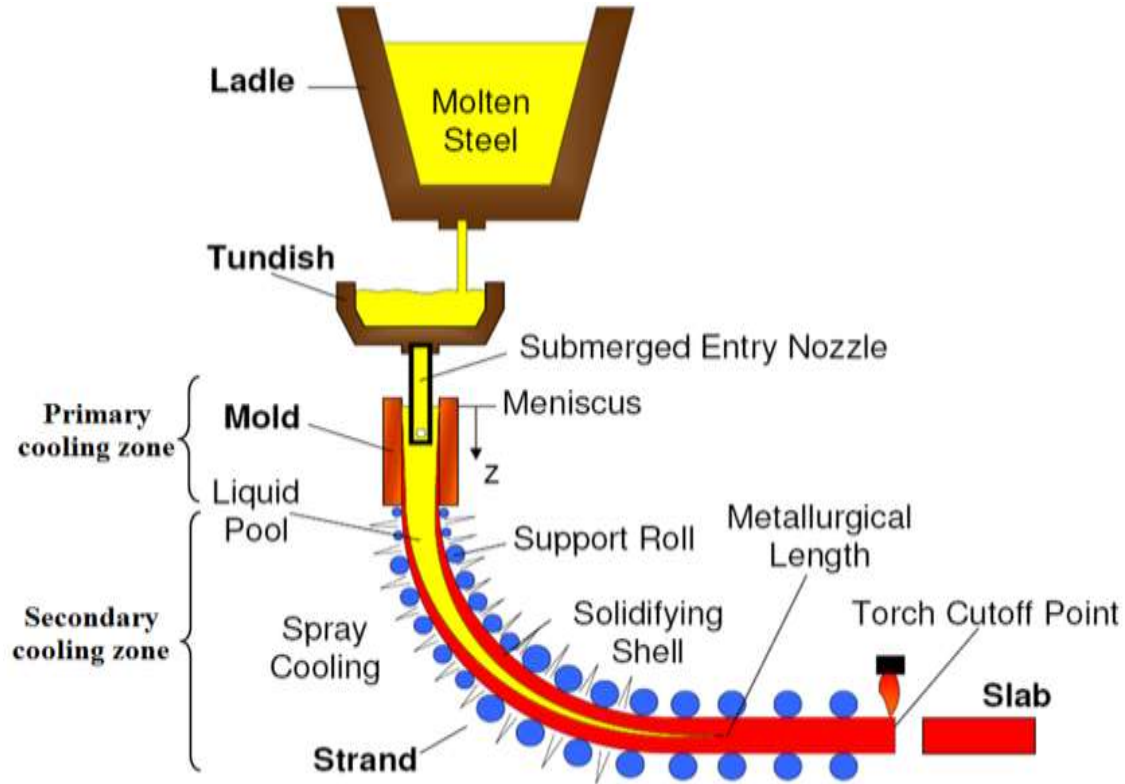
- This solid shell hold the ferrostatic pressure of liquid metal.
- Further, solid shell is continuously extracted at predetermined rate.
- Rollers are provided for extraction from mold and guide to complete solidification.
- It is then further solidified and cooled by water sprays.
- After complete solidification and getting desired length, get cut by suitable cut-off apparatus.

CONTINUOUS CASTING

- Advantages:
 - 100% casting yield, the process can be easily mechanized.
 - Unit labour cost is less.
 - Casting surfaces are better, Grain size and structure can be easily controlled.
- Applications:
 - Materials such as brass, bronzes, zinc, copper, aluminium and its alloys, magnesium, Iron, steel etc. can be cast.
 - Production of blooms, billets, slabs, sheets, copper bar etc.
 - It can produce any shape of uniform cross-section such as round, rectangular, square, hexagonal, fluted or gear toothed etc.



CONTINUOUS CASTING



THANKS

